7. For a *Design for Stoves;* Chas. J. Woolson, Cleveland, Ohio, April 10.

Claim.—"What I claim as new, is the configuration and arrangement of said ornaments as designated and represented."

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8. For a *Design for Stoves;* John and Alexander Morrison, assignees of Abram Haney, Troy, New York, April 17.

Claim.—"What I claim as my invention, is the combination and arrangement of ornamental figures and forms, represented in the annexed accompanying drawings, making an ornamental design for a coal stove."

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9. For a *Design for Stoves;* Samuel H. Ransom, Albany, New York, April 24.

Claim.—"What I claim as my invention, is the combination and arrangement of ornamental forms and figures, represented in the accompanying drawings, forming an ornamental design for a cooking stove."

MECHANICS, PHYSICS, AND CHEMISTRY.

For the Journal of the Franklin Institute.

On the Dimensions of Steam Engine Chimnies. By MR. H. F. FAIRBAIRN.

The inquiry which appears in the June number of the Journal of the Franklin Institute, on the subject of the dimensions of steam engine chimnies, is one of the greater importance to Philadelphia, as it is certain that both beauty and profit can be made to arise out of the chimnies of the manufacturing establishments which may be founded in the city in future times. Philadelphia may be much beautified by the graceful forms of its steam engine chimnies, and a great annual saving in the consumption of fuel may be also made, in a city where fuel is destined to be at all times dear. Pleasure and profit may, therefore, be found in the construction of chimnies upon true mathematical rule.

Speaking comprehensively, the same rules may be given for the building of chimnies as for the proportions of columns; that one-half of the diameter should be diminished between the base and the capital; that the length of the shaft should be eight times the diameter of the base; and that the chimney should be circular in every part.

The same laws of resistance govern material and invisible substances; the cannon ball, the smoke from the cannon, and the sound of the cannon, all travel in the same direction, and with a velocity proportioned to the resistance of the air or the land. And as the sound of the cannon, so the sound of the human voice, and the sight of the human eye, must be governed by the same force of resistance to its progress over surfaces; and as the most gradual diminution of the diameter from the perpendicular line produces the least singularity, and therefore the least resistance to the passage of the eye over the external surfaces of a column, so the same form and dimensions will allow of the least resistance to the passage of smoke

over the internal surfaces of chimnies, and that chimney is the best which will the most rapidly transmit the smoke to the external air.

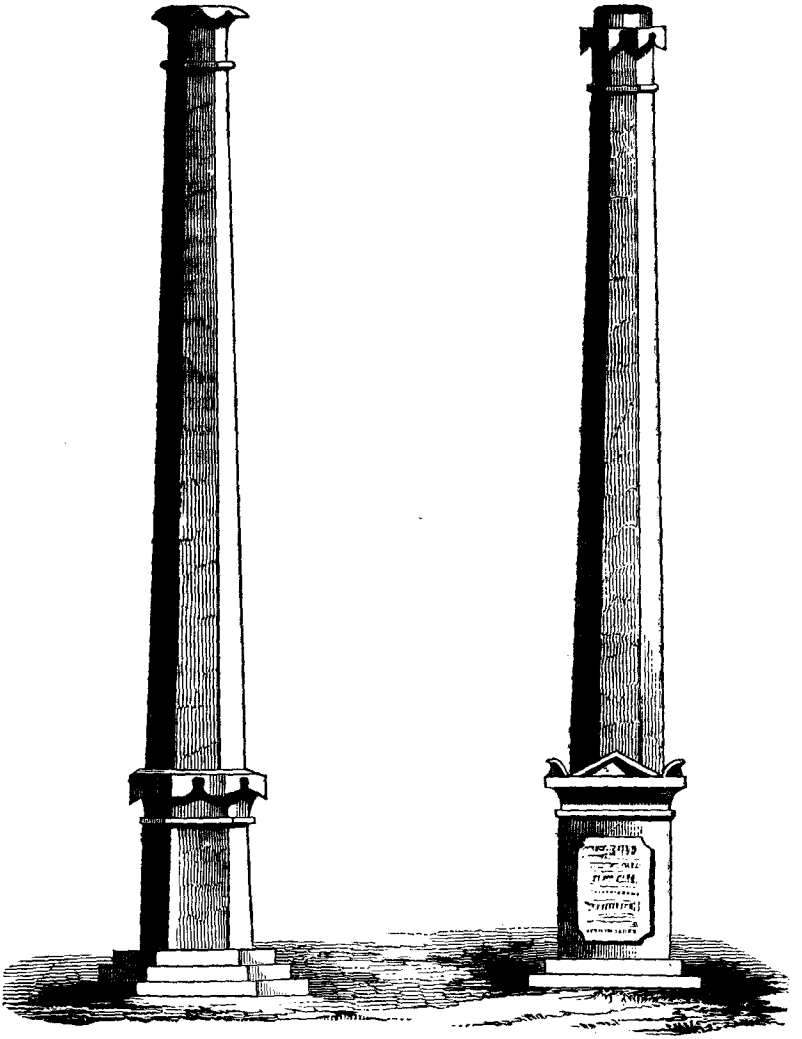
The finest steam engine chimney which yet has been erected in England is that of the West Middlesex Water Works Company, at Turnham Green, in the vicinity of London. This chimney is more beautiful as a column than the monument of London,—a pillar which was built by Sir Christopher Wren, in commemoration of the great fire in the reign of Charles II. It is crowned by a Corinthian cap of fine proportions with every other part of this noble specimen of a steam engine chimney, which is only deficient in the inferior color of the bricks of which it is built, and in its position, which is neither on elevated ground, nor in a part of the country where its beauties can be very fully displayed; but the proportions of this chimney are considered to be complete.

In the town of Manchester, in England, there are also many steam engine chimnies of great beauty of proportion, by means of which immense quantities of bituminous coals are burnt without any loss of heating power, these chimnies seldom exhibiting the appearance of sensible smoke. The cotton manufacturers of Manchester vie with one another in the height and proportions of the steam engine chimnies, and some failures, in the foolish extreme of building the highest and most ambitious, but, at the same time, too perpendicular chimnies, have brought those now erected to be generally perfectly columnar in form, and not more ornamental to the town than economical in the consumption of coals, and very greatly beneficial to the health of Manchester, by the cessation of the black cloud of smoke which formerly vulgarized that great English manufacturing town. However large the outlay of money for the chimney, this is now seldom considered by the manufacturer, for the saving of coals, and the efficiency of the steam engine, repay almost any expense so incurred; and it has been long since discovered that Manchester may be improved by the beauty of the steam engine chimnies, and that the pocket of the manufacturer may be improved at the same time.

Two specimens of design in this description of architecture, taken from a work on Manchester, which was published some years since, will be found on the following page.

In these chimnies the internal diameter is uniform throughout the entire length of the shaft, and this is all that can usually be expected to be obtained without an increased expense, which will seldom be undergone by manufacturers for the purpose of carrying out the mechanical and the chemical principles which apply to any particular trade. But on true scientific principles, the internal diameter should certainly be diminished gradually as the chimney ascends, for it is clear that, as the smoke and gas pass further through the brick work, which has been cooled down in the proportion in which it is removed further from the furnace wall, (the original source of the heat,) the surface of resistance ought to be decreased and the chimney made narrower. As the heat of the smoke decreases its condensation increases, and its expansion and ascending power diminished in the ratio in which the heat is lost. A gradual compression of the internal diameter would be the perfect mode of constructing chimnies on all the chemical and mechanical rules which apply to the passage of heated air.

The chimnies here shown are externally of an octagonal form, this being thought, by the author of the work on Manchester, to be capable of a finer ornamental effect in the blending of light and shade. "The association of light and shade is more striking in the octagonal than in the circular form of chimnies. In the former, the three great degrees of light and shade are produced, namely, light, middle tint, and shadow. In the latter, the



extremes of light and shade, pass insensibly into each other, and produce but a feeble effect when compared to the finer and the clearer tints of the octagonal form." There is much good taste in these observations, and the effect of light and shade is still more worthy of attention in the production of the ornamental of Philadelphia than of Manchester, as the climate is

not so clear in England, and the effect of light and shadow very much less marked and imposing than in the United States. The sky in Pennsylvania is of the dark blue color of the parallel latitudes on the Mediterranean Sea, and as the effect of the minarets and other columnar structures of Venice and Constantinople is derived from finely graduated proportions, when seen against the finest of skies, and as there is no smoke perceptible from the chimnies of the greatest elevation in the manufacturing districts of England, (for the combustion is rendered perfect by the powerful draft of these chimnies,) so in Philadelphia there will be, still more than in England, a removal of all traces of black smoke where anthracite coal is in use, and consequently a removal of that which mars the purity of the architectural effect of a column seen against the usually clear blue sky.

An octagonal chimney is, therefore, recommended for its production of strong tints of light and shade, and for its variety as amongst other chimnies of the circular or the square form, and because it is not more expensive of construction than a chimney circular throughout.

Respecting the ornamental work of a chimney, its shewing the cap of the Corinthian or of any other order of columnar architecture, it is requisite that keeping be studied with reference to the general architectural character of the city in which the building stands. The city of Philadelphia is plain—was laid out by a man eminently mathematical in his mind; utility was in the view of the founder of the city of right angles, but then utility includes proportion, and in proportion all solid beauty finally resides. The Corinthian column may be thought to be not in true keeping with the general character of the architecture of Philadelphia, nor are there wanting those who think that all ornaments to columns have been the production of ages when taste has been on the decline; that neither the acanthus flower nor the horn of the ram are in their natural places when growing out of the tops of columns of stone, but that the Doric columns of the Parthenon remain the most impressive, although the plainest, of all the structures of the columnar kind. The chimnies given from the work on Manchester are of a description suitable to the general architecture of Philadelphia, plain but not absolutely without ornament, with pedestals and tablets of marble or other material, recording the history of the erection of the place, and becoming a *monumentum in perennio* to the manufacturer and citizen of Philadelphia, who shall have built the finest architectural column and saved the most anthracite coal at the same time.

There is some difficulty to be expected in the establishment of a perfectly scientific system of chimney building in the city of Philadelphia, as there are erroneous models already in existence, the errors being very grevious of those which are the highest, and the best shown with regard to their dimensions, internal and external, and which are the most inquired after by those who are erecting iron works and other manufactories in the interior of the State.

The chimney of Messrs. Powers & Weightman, manufacturing chemists, in Spring Garden, Philadelphia, is the highest in the United States. This chimney is square and its internal diameter increases towards the top; two errors which have been disseminated from this chimney extensively through the State, almost all the iron works which have been erected during the last ten years having chimnies of similar form and internal dimensions as

the Philadelphia chimney of the chemists, which appears to be the model chimney of the State. It is argued that the plan of this chimney was brought from Europe as the best of all chimnies; that it has answered the purpose well; the nuisances of the former chemical works have disappeared from the air of Philadelphia, and the eminent firm of manufacturing chemists are sufficiently satisfied with the effect which has been produced.

But against this, it is to be remembered that the chimney is 126 feet in height; that the vast expense here incurred was for a purpose, to accomplish which capital was not regarded so much as success, and that although air and smoke sufficient for a comparatively limited purpose can be passed through a tube of excessive length, this is no reason why the same currents of air should not be passed through better formed chimnies, of considerably less height, costing considerably less money, and looking very much more beautiful to the eye. The chimney of the Spring Garden chemists will "do very well," but that is no reason why other manufacturers ought not to go further into its merits before adopting, in other situations, a model which has no other merit than that it is the highest and most striking to the view of all the chimnies which yet have been erected in the United States.

It is also said that the same manufacturing firm have proved their case as in favor of the square chimney, by the erection of a circular chimney at their other works, at the Falls of Schuylkill, and that "no good has been obtained" by the erection of this latter chimney in a circular form. Here let it be observed that the chimney at the Falls of Schuylkill is circular undoubtedly, but it has been curtailed of its fair proportions, is deficient by full one-sixth part of the true columnar proportions, and it is not singular that no better effect should be produced in the draft of air through a stunted circle than through a square of redundant length. The chimney at the Falls of Schuylkill has no pretensions to the proportions of a model, and until a circular chimney, of the same height with a square chimney, shall be shown to have carried away a smaller volume of smoke, and therefore to have overthrown all the established principles of chemistry and mechanics, it is not sufficient that there can be a circular chimney, otherwise defective in its construction, which shall be no better than a square chimney, which has been built at double the expense.

The chimnies of steam engines scattered through Pennsylvania are almost all erroneous in formation, and particularly at the various iron furnaces of the State. There are chimnies built on the principle of the chimney of the chemical manufactory of Spring Garden, which, in consequence, waste an expense of thousands of dollars per annum for coal; one of these chimnies on the Schuylkill river, for a steam engine of 90 horse power, costing $7000 per year, at the rate of five tons of coal per day at $4 per ton; and yet the boilers of this engine are fitted with all the apparatus for conveying the hot air from the tunnel head of the furnace; nor would there be any coals whatever required were the chimney not built widening towards the top, and capable of carrying off only about one-third part of the proper column of air, which the furnace could easily supply.

The subject of the form of steam engine chimnies is one of leading importance to the iron manufacture of the State, and though iron furnaces are not situated in cities, and the ornamental is not the first of considerations,

yet is there very great loss of capital incurred by the erection of chimnies which, in the words of "H." are "square masses of brickwork of small elevation," &c.

To be a column, eight diameters of the base is the height of the shaft, and with a diminution of one-half of the diameter at the top, are, therefore, the leading proportions to be preserved in the view of the builder of a steam engine chimney; the external ornament of circle or octagon, of capital or none, and other such considerations, being of less importance, and depending upon circumstances for which there is no general rule."

For the Journal of the Franklin Institute.

The American Steam Navy.

In the October number of the Journal, I alluded to the steam vessels belonging to our Navy, and which at that time, including *all classes*, numbered seven. Since then, the "Edith" has been lost in the Pacific, so that we are now reduced to six, and five of that number are very indifferent vessels, leaving the "Mississippi" alone to sustain the credit of the country, and, so far as one vessel can, she will nobly do it.

There are now building four steamers, the "Powhattan," "Susquehanna," "Saranac," and "San Jacinto." The first at Norfolk, the second at Philadelphia, the third at Portsmouth, N. H., and the last at New York. The first two are 250 feet long, and 45 feet beam, and the last two are 196 feet long, and 37 feet beam. The first two have side wheels, and two inclined engines, each with cylinders 70 inches diameter, and 10 feet stroke; the third has side wheels and 2 inclined engines, with 60-inch cylinders, 9 feet stroke, and the fourth has a propeller and two inclined engines, working across the ship, with cylinders 60 inches in diameter, 4 feet 2 inches stroke.

When it is taken into consideration that, in war steamers, every foot of room possesses a double value from the large number of men that have to be accommodated, we may well inquire why it is that *all* of these vessels have engines that take up so much space in the ship, to the discomfort of every one on board. The space between bulkheads, on the "Susquehanna," is 89 feet of the widest part of the vessel. Without disturbing the arrangements of the boilers, engines of equal efficiency, and less weight and cost, could have been put in, and the whole space occupied reduced to 60 feet. In fact, no other form of marine engine at present known, could be *spread over as much space* as the inclined engine adopted in these vessels. To be sure, by adopting some other form, we could not have used several so called valuable *American Patents*, but what was lost by the inventors would have been doubly gained to the country.

The Board of Engineers, who determined the form of engines for these vessels, were of *one opinion*, that nothing but inclined engines should be used. Their *reasons* have never been made public, and while all the engineers of this country and Europe are in the dark as to the advantages of this form of engine, the Navy Department very unfairly keeps all the information to itself.

The use of the inclined engine has heretofore compelled the decking over of the lower part of the engine, to obtain room for stores, &c., and